We claim:

1. A method of determining the vibrational modes of a cantilever to improve the accuracy of a scanning force microscope comprising the steps of:

providing a cantilever composed of a material having a known Young's modulus, E;

determining the cross sectional area, A, of the cantilever;

determining the length, L, of the cantilever;

determing the geometric moment of inertia, I, of the cantilever;

calculating the vibrational modes of the cantilever based upon the following equations:

$$\frac{1+\cos\xi_n \cdot \cosh\xi_n}{\sin\xi_n \cdot \cosh\xi_n - \cos\xi_n \cdot \sinh\xi_n}\xi_n^3 = \beta$$

$$n_n=(A^{1/2}\,V)/(2pL^2)\,x_n^2$$

wherein:

$b=GL^3/EI$; and

G= slope of a force–distance curve; and

electronically calibrating the scanning force microscope based upon the vibrational modes.

2. The method of claim 1, further comprising the step of exciting a first transducer positioned proximate a fixed end of the cantilever so that the cantilver enters a plurality of natural vibrational modes.

3. The method of claim 2, wherein the step of exciting the first transducer comprises exciting the first transducer through a range of frequencies.

4. The method of claim 2, further comprising the step of detecting motion at a free end of the cantilever.

5. The method of claim 4, wherein the step of detecting motion at the free end of the cantilever comprises detecting vibrations through a second transducer attached to the free end of the cantilever.

6. The method of claim 5, further comprising the step of comparing the detected motion at the free end of the cantilever to the excitation proximate the fixed end of the cantilever to determine the vibrational modes of the cantilever.

7. A method of determining the resonant frequencies of a cantilever comprising the steps of:

fixedly attaching a cantilever having a length of at least one centimeter to a base, wherein a distal end of the cantilever remains free;

exciting the cantilever proximate the base, wherein the excitation occurs through a range of frequencies;

measuring any displacement in the distal end of the cantilever simultaneous to the step of exciting the cantilever; and

detecting a plurality of resonance frequencies by comparing the measured displacement in the distal end of the cantilever to the excitation.

8. The method of claim 7, wherein the step of exciting the cantilever comprises attaching a first piezo-electric crystal to the cantilever proximate the base and electrically exciting the first piezo-electric crystal.

9. The method of claim 8, wherein the step of measuring any displacement in the distal end of the cantilver comprises attaching a second piezoelectric crystal to the distal end of the cantilever and measuring an electric signal generated by the second piezoelectric crystal.

10. The method of claim 9, wherein the step of detecting the plurality of resonance frequencies comprises ploting the electrical excitation of the first piezoelectric crystal against the measured signal generated by the second piezoelectric crystal.

11. The method of claim 7, wherein the step of fixedly attaching a cantilever comprises providing a cantilever having a known spring constant, κ.

12. The method of claim 11, further comprising the step of determining a slope of a force separation curve, k, based upon the following equation:

$$\frac{1}{3}\frac{1+\cos\xi\cdot\cosh\xi}{\sin\xi\cdot\cosh\xi-\cos\xi\cdot\sinh\xi}\xi^{3}=\frac{k}{\kappa}$$

13. The method of claim 9, wherein the step of attaching a second piezoelectric crystal to the distal end of the cantilever further comprises positioning a buffer between the cantilever and the piezoelectric crystal.

14. A measurement device configured to detect the resonant frequencies of a cantilever comprising:

a base;

a cantilever having a fixed end attached to the base and a free end opposite thereto, wherein the cantilever is at least one centimeter in length;

a first transducer connected with the cantilever along the fixed end;

a second transducer configured to measure any displacement in the free end of the cantilever; and

a display configured to plot a signal from the second transducer.

15. The measurement device of claim 14, wherein the first transducer comprises a piezoelectric crystal connected with the cantilever through a buffer.

16. The measurement device of claim 14, wherein the second transducer comprises a piezoelectric crystal connected with the cantilever through a buffer.

17. The measurement device of claim 14, further comprising a signal generator configured to excite the first transducer through a range of frequencies.

18. The measurement device of claim 17, wherein the display is configured to plot the signal from the second transducer against the excition to the first transducer so that resonant frequencies generate an eliptical Lissajous figure.